CS206 Data Structure

Homework #1

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0 About Programs

Program Language: C# 5.0 based on .NET Framework 4.5
Libraries: Standard library of .NET(ex: mscorlib.dll, System.Core.dll, System.Linq.dll)
Complier: C# Compiler in Visual Studio 2012 Update 4 (Any CPU)
Type of Executable File: .exe
Requirements: OS that supports .NET Framework 4.5(ex: Windows 7, 8, 8.1)

1 Program1

Executable File: Program1.exe
Source Files: Polynomial.cs, Term.cs, Program1.cs
Instruction: Program1.inst.txt
Sample Input, Output: Program1.sample.txt

2 Program2

Executable File: Program2.exe
Source Files: Polynomial.cs, Term.cs, Program2.cs
Instruction: Program2.inst.txt
Sample Input, Output: Program2.sample.txt

3 Polynomial Calculus ADT

structure Polynomial
objects: a polynomial $\sum_{i=0}^{n} a_i x^i$ where $i \in \mathbb{N}_0 \wedge \forall_i\, a_i \in \mathbb{Z}$
functions: $(\forall poly1(= \sum_{i=0}^{n_1} a_i x^i), poly2(= \sum_{i=0}^{n_2} b_i x^i) \in Polynomial)$

Polynomial **ADD**(*poly*1, *poly*2)
Let $\forall_{i>n_1}\, a_i = 0 \wedge \forall_{i>n_2}\, b_i = 0$
return $\sum_{i=0}^{max\{n_1,n_2\}} (a_i + b_i) x^i$

Polynomial **MULTIPLY**(*poly*1, *poly*2)
return $\sum_{i=0}^{n_1} \sum_{j=0}^{n_2} (a_i \cdot b_j) x^{i+j}$

Polynomial **DIFFERENTIATE**(*poly*1)
return $\sum_{i=1}^{n_1} i a_i v^{i-1}$

4 New Operations of Polynomial Calculus ADT

Adding following additional operations will make polynomial calculus ADT useful.

structure Polynomial

functions: $(\forall poly1(=\sum_{i=0}^{n_1} a_i x^i), poly2(=\sum_{i=0}^{n_2} b_i x^i) \in Polynomial,\ v \in \mathbb{R})$

Polynomial **NEGATE**(*poly*1) ▷ Get a negated polynomial
return $\sum_{i=0}^{n_1}(-a_i)x^i$

Polynomial **SUBTRACT**(*poly*1, *poly*2) ▷ Subtract two polynomials
return ADD(*poly*1, NEGATE(*poly*2))

Polynomial **INTEGRATE**(*poly*1) ▷ Integrate a polynomial. C = 0
return $\sum_{i=0}^{n_1} \frac{a_i}{i+1} x^{i+1}$

double **SUBSTITUTE**(*poly*1, *v*) ▷ Substitute x = v in a polynomial
return $\sum_{i=0}^{n_1} a_i v^i$